CHANDRA OBSERVATIONS OF THE CRAB NEBULA AND PULSAR

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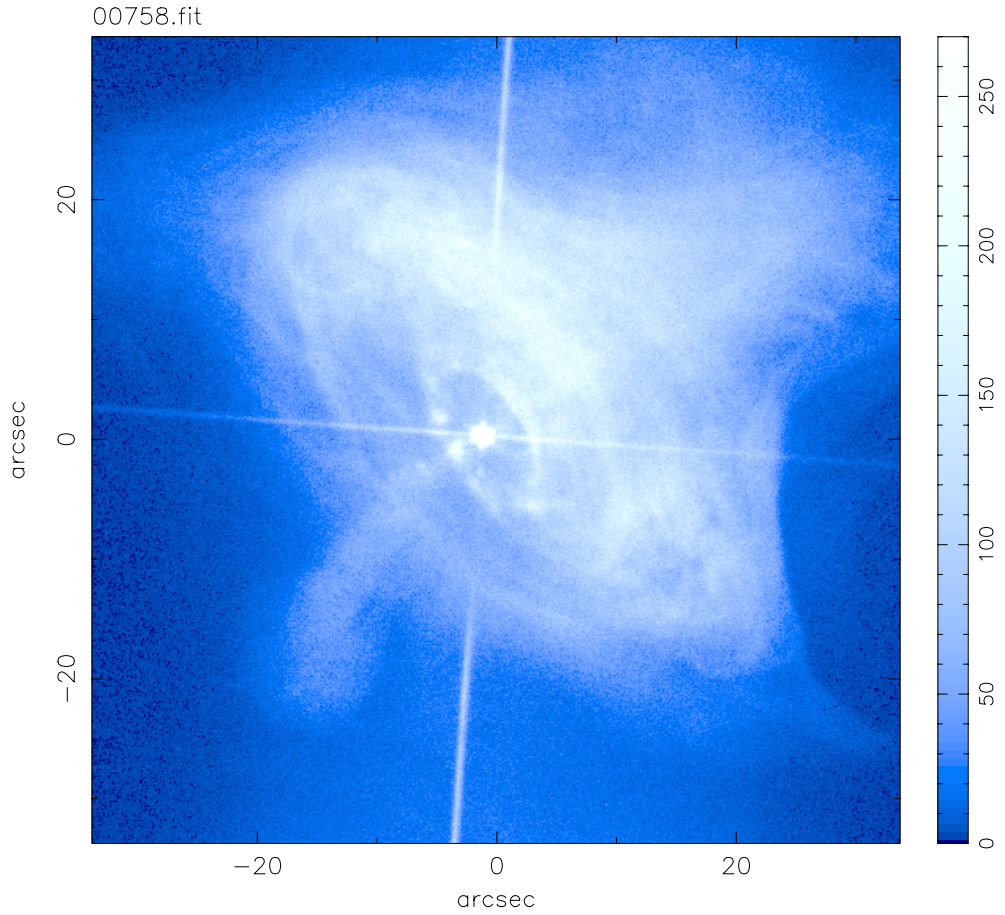
OVERVIEW

SEARCH FOR THERMAL EMISSION FROM THE CRAB PULSAR

APPROACH:

- LETG/HRC-S IN ZEROTH ORDER
  - HRC REQUIRED FOR TIMING
  - LETG REQUIRED AS A “NEUTRAL DENSITY” FILTER
- STUDY IMAGE AND FLUX AS FUNCTION OF PULSE PHASE

LETGS/HRC-S ZEROTH ORDER



COMPLICATION(S)

HRC TIMING ANOMALY

- TIME TAG OF THE N-TH TRIGGER BELONGS WITH EVENT N+1

NOT ALL TRIGGERED EVENTS ARE TELEMETERED

- EVENTS LOST DUE TO TELEMETRY SATURATION (BUFFER FULL)
- EVENTS LOST DUE TO ON-BOARD FILTERING

HRC TEAM IDENTIFIED PROBLEM AS A WIRING ERROR

- NOW FULLY UNDERSTOOD

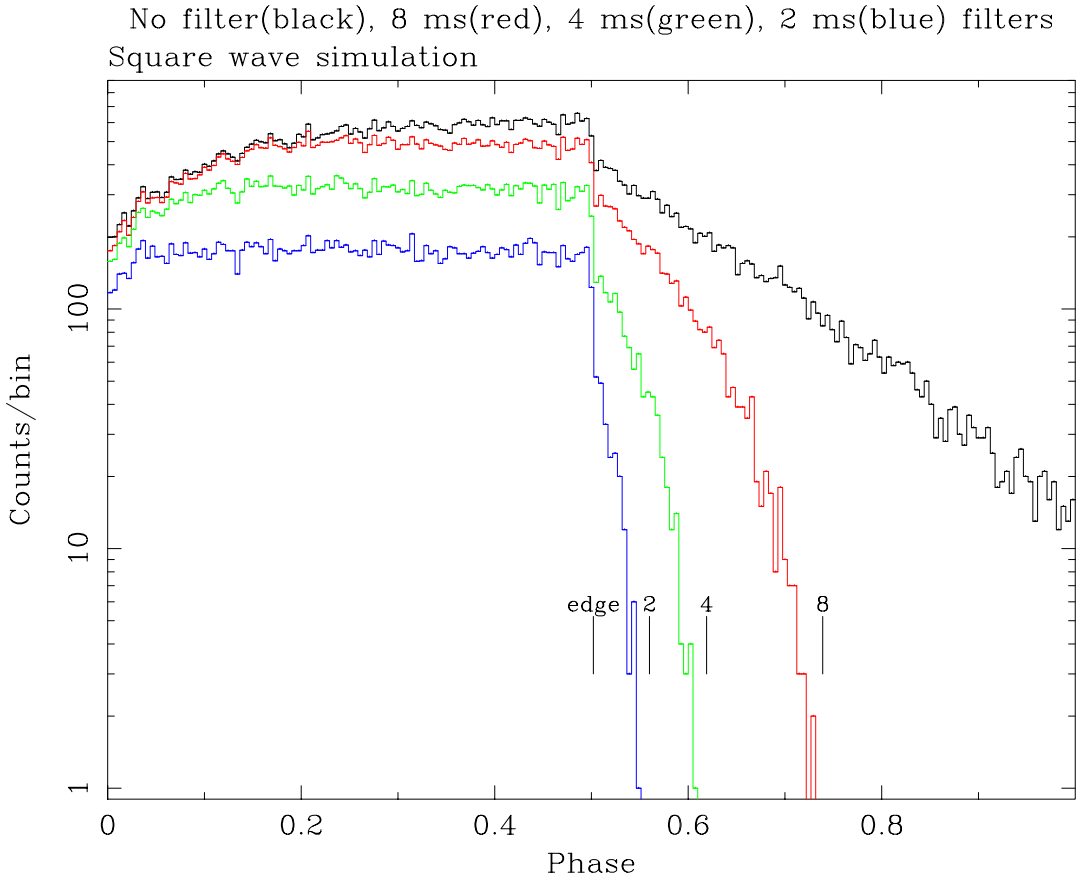
HOW TO DEAL WITH TIMING ANOMALY

SHIFT TIME OF EACH EVENT

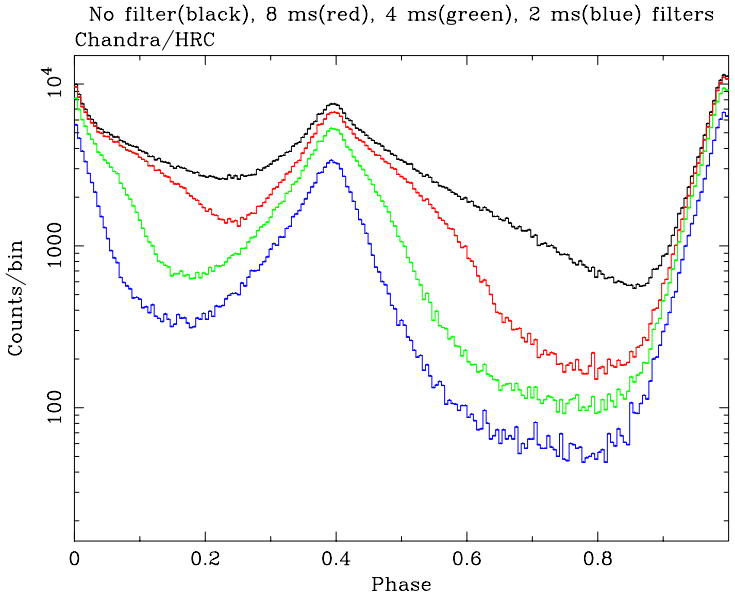
FILTER ON TIME BETWEEN EVENTS

- DISCARDS DATA
- BOUNDS THE TIME ERROR

SQUARE-WAVE SIMULATION

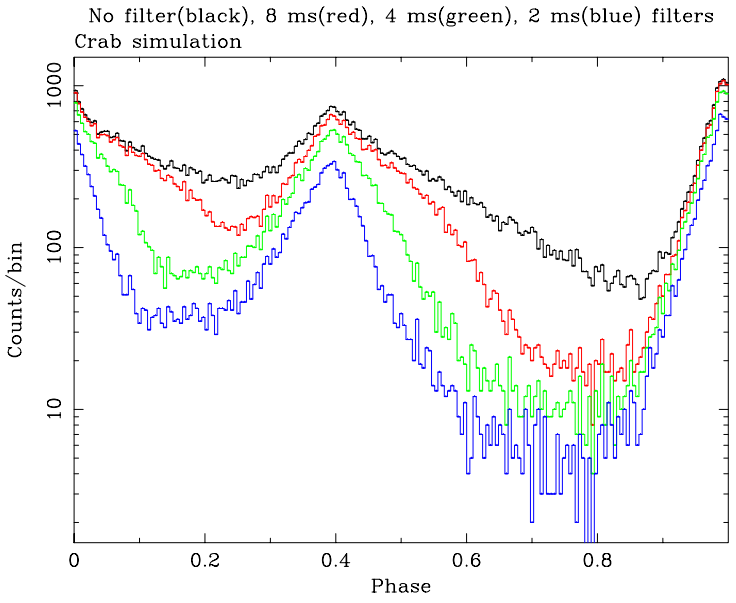


IMPACTS OF FILTERING



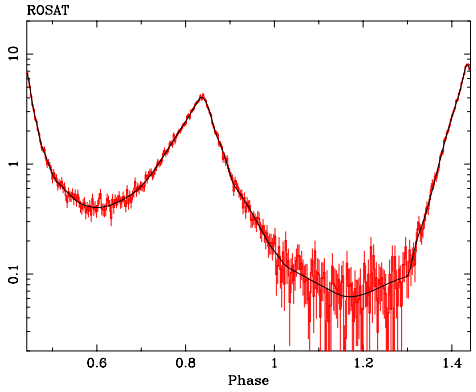
DATA

SIMULATION

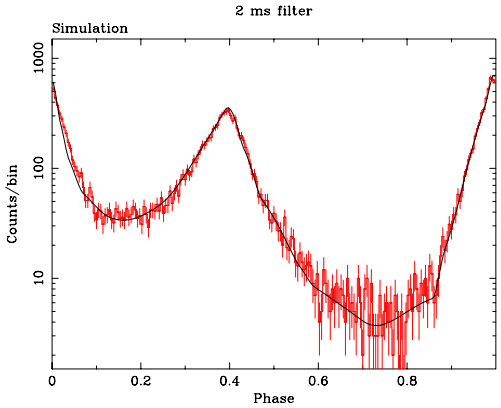


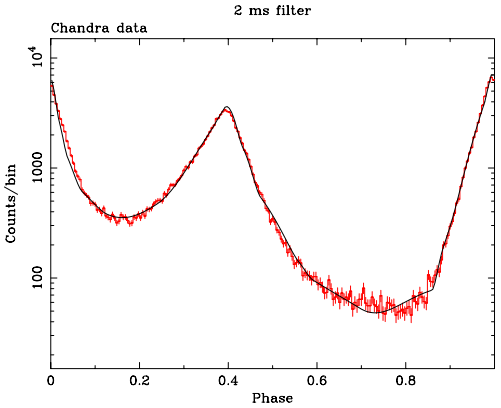
PULSE PROFILES

ROSAT



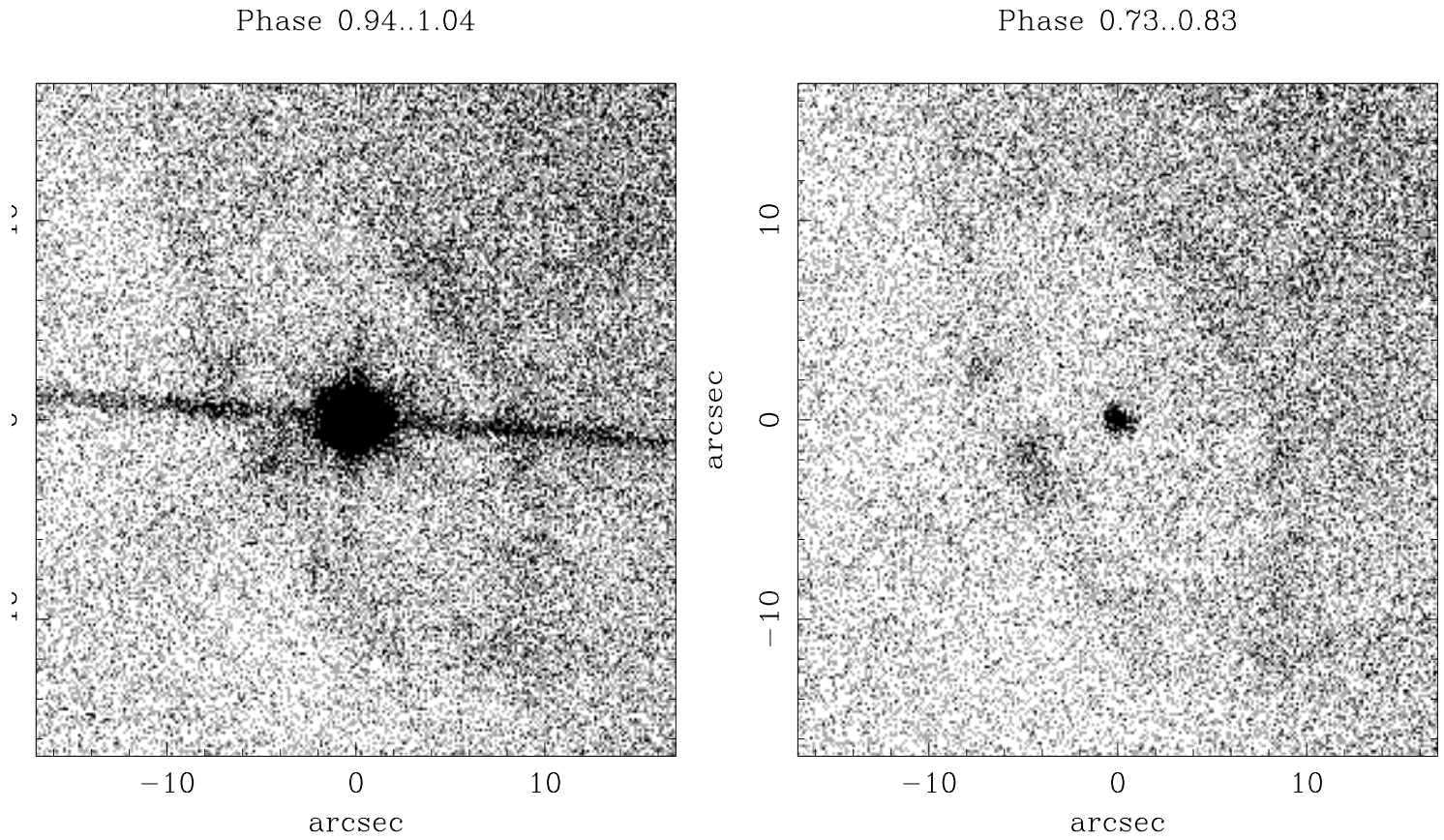
SIMULATION





CHANDRA

IMAGES AT PULSE MAXIMUM AND MINIMUM



DETECTED FLUX IS HIGHER THAN PREVIOUS UPPER LIMIT SET WITH ROSAT

WHY?

ROSAT UPPER LIMIT SPURIOUSLY LOW

- ROSAT ANALYSIS OVER-SUBTRACTED THE LOCAL BACKGROUND (AND UNDER ESTIMATED UPPER LIMIT) DUE TO THE INABILITY TO RESOLVE THE INNER RING
- CONCEPTUAL AND NUMERICAL ERRORS IN CALCULATING THE UPPER LIMIT

IF FLUX IS DUE TO THERMAL EMISSION WHAT IS THE TEMPERATURE?

T_∞ LESS THAN 2.3 X 10^6 K FOR CANONICAL PARAMETERS AND SIMPLE BB RADIATION

- N_h = 3.0 10^{21}
- D = 2 kpc
- M = 1.4 M_{sun}
- R_∞ = 10 km

SUSPECT THAT MUCH OF THIS FLUX NOT THERMAL

NO REASON FOR PULSAR TO BE 100% BEAMED

OPTICAL FLUX RECENTLY DETECTED AT ALL PULSE PHASES (Golden, Shearer, Beskin 2000 ApJ 535, PP373-3378)

OPTICAL/X-RAY FLUX RATIOS APPEAR SIMILAR